CLAIMS

1. In an apparatus for transmitting a radio frequency signal to activate a device implanted in an animal, an antenna assembly to which the radio frequency signal is applied and which has a substantially planar structure, the antenna assembly comprising a first antenna, a second antenna and a third antenna stacked on top of one another, wherein the first antenna produces a first electromagnetic field in a first direction, the second antenna produces a second electromagnetic field in a second direction which is substantially orthogonal to the first direction, and the third antenna produces a third electromagnetic field in a third direction which is substantially orthogonal to the first direction and the second direction.

2. The apparatus as recited in claim 1 wherein the first antenna has a first planar coil section on one side of a first axis and a second planar coil section located on another side of the first axis.

3. The apparatus as recited in claim 2 wherein the second antenna has a third planar coil section on one side of a second axis and a fourth planar coil section located on another side of the second axis, wherein the second axis is substantially orthogonal to the first axis.

4. The apparatus as recited in claim 3 wherein each of the first planar coil section, second planar coil section, third planar coil section, and fourth planar coil section comprises two coil turns.

5. The apparatus as recited in claim 3 wherein:

the first antenna further comprises a first node and a second node between which the first planar coil section and the second planar coil section are connected, and a first impedance matching circuit connected to the first node and a second node for coupling a transmission line to the first antenna; and

the second antenna further comprises a third node and a fourth node between which the third planar coil section and the fourth planar coil section are connected, and a second impedance matching circuit connected to the third node and a fourth node for coupling another transmission line to the second antenna.

6. The apparatus as recited in claim 3 wherein the third antenna has single planar coil having two ends.

7. The apparatus as recited in claim 6 further comprising an impedance matching circuit connected to the two ends for coupling a transmission line to the third antenna.

8. The apparatus as recited in claim 6 wherein the first antenna, the second antenna and the third antenna are different sizes so that their respective coil sections do not overlap.

9. The apparatus as recited in claim 1 wherein the first antenna has at least a first pair of conductive lobes with one conductive lobe extending on one side of a first axis and another conductive lobe extending on another side of the first axis.

10. The apparatus as recited in claim 9 wherein the second antenna has at least a second pair of conductive lobes with one conductive lobe of which extending on one side of a second axis and another conductive lobe of which extending on another side of the second axis.

11. The apparatus as recited in claim 10 wherein second axis is substantially orthogonal to the first axis.

12. The apparatus as recited in claim 1 wherein the third antenna comprises at least one conductive loop with a gap.

13. In apparatus for transmitting a radio frequency signal to a device implanted in an animal, an antenna assembly comprising:

a first antenna to which the radio frequency signal is applied to activate the medical device is applied and having a first coil section on one side of a first axis of symmetry and a second coil section located on another side of the first axis of symmetry;

a second antenna to which the radio frequency signal is applied to activate the medical device and having a third coil section on one side of a second axis of symmetry and a fourth coil section located on another side of the second axis of symmetry, wherein the second axis of symmetry is orthogonal to the first axis of symmetry; and

a third antenna to which the radio frequency signal is applied to activate the medical device and having a conductive loop a gap.

14. The apparatus as recited in claim 13 wherein each of the first, second, third and fourth coil section comprises at least one curved lobe having two ends, and a linear conductor connected to one end and extending to a point adjacent the other end.

15. The apparatus as recited in claim 13 wherein the first coil section and the second coil section of the first antenna each have a plurality of turns.

16. The apparatus as recited in claim 15 wherein the third coil section and the fourth coil of the second antenna section each have a plurality of turns.

17. The apparatus as recited in claim 13 wherein the first antenna, the second antenna and the third antenna are stacked on top of one another in a flat assembly.

18. The apparatus as recited in claim 17 wherein each of the first, second, and third antennas has a center point with all the center points being substantially aligned.

19. The apparatus as recited in claim 17 wherein the respective coil sections of the first antenna, and the second antenna have curved lobes which do not overlap in the flat assembly.

20. The apparatus as recited in claim 13 wherein the first antenna and the second antenna are formed by conductive patterns on opposite sides of a first substrate, and the third antenna is formed by a conductive pattern on a second substrate that is parallel to the first substrate.

21. The apparatus as recited in claim 13 wherein the antenna assembly is substantially planar.

22. The apparatus as recited in claim 13 wherein the third antenna has a pair of concentric conductive loops, each having a gap.

23. The apparatus as recited in claim 13 further comprising a signal divider coupled to the first, second, and third antennas and dividing the pulsed signal into three portions each of which is applied to a different one of the antennas.

24. The apparatus as recited in claim 23 wherein the signal divider is coupled to each of the first, second, and third antennas by a balun and an impedance matching circuit.

25. The apparatus as recited in claim 23 wherein the signal divider is coupled to the first antenna by a mechanism wherein the portion of the pulsed signal which is applied to the first antenna is ninety degrees out of phase from the portion of the pulsed signal which is applied to the second antenna.

26. In an apparatus for transmitting a radio frequency signal to a device implanted in an animal, an antenna arrangement comprising:

a first antenna, a second antenna, and a third antenna each having a planar structure with one of the first, second, and third antennas located between the other two antennas;

each of the first antenna and the second antenna having a first lobe extending to one side of an axis and spaced apart first and second ends, a second lobe having spaced apart third and fourth ends and extending within the first lobe with the third end adjacent the first end, a third lobe extending to an opposite side of the first axis and having spaced apart fifth and sixth ends, a fourth lobe having spaced apart seventh and eighth ends and extending to the opposite side within the third lobe with the seventh end adjacent the fifth end, the first end of the first lobe is connected to the fourth end of the second lobe, the second end connected to a node between the first end of the first lobe and the fifth end of the third lobe and separated there from, the sixth end is connected to the node, and the third end of the second lobe is connected to the seventh end of the fourth lobe;

wherein the axis of the first antenna is orthogonal to the axis of the second antenna; and

the third antenna having a first annular conductor with ninth and tenth ends with a gap there between, and a second annular conductor inside the first annular conductor and having eleventh and twelfth ends with another gap there between, wherein the tenth end is connected the eleventh end.

27. The apparatus as recited in claim 26 wherein the first and second lobes have a generally semicircular shape.

28. The apparatus as recited in claim 26 wherein each of the first and second antennas further comprises an impedance matching circuit connected to the node, the third end and the seventh end for coupling a transmission line to the respective antenna.

29. The apparatus as recited in claim 26 wherein third antenna further comprises an impedance matching circuit connected to the ninth end and the twelfth end for coupling a transmission line to the third antenna.